May 1994

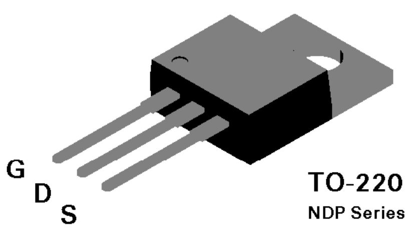
NDP608A / NDP608AE / NDP608B / NDP608BE
NDB608A / NDB608AE / NDB608B / NDB608BE
N-Channel Enhancement Mode Field Effect Transistor

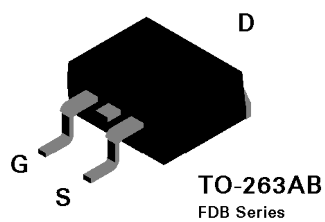
General Description

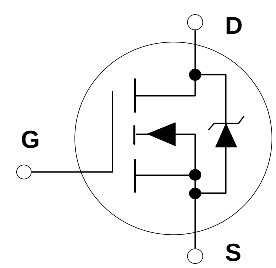
These N-channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulses in the avalanche and commutation modes. These devices are particularly suited for low voltage applications such as automotive, DC/DC converters, PWM motor controls, and other battery powered circuits where fast switching, low in-line power loss, and resistance to transients are needed.

Features

- 36 and 32A, 80V. $R_{DS(ON)}$ = 0.042and 0.045Ω.
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- 175°C maximum junction temperature rating.
- High density cell design (3 million/in²) for extremely low $R_{DS(ON)}$.
- TO-220 and TO-263 (D^2PAK) package for both through hole and surface mount applications.







Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter	NDP608A NDP608AE NDB608A NDB608AE	NDP608B NDP608BE NDB608B NDB608BE	Units
V_{DSS}	Drain-Source Voltage	80		V
V_{DGR}	Drain-Gate Voltage (R_{GS} ≤ 1 MΩ)	80		V
V_{GSS}	Gate-Source Voltage - Continuous	±20		V
	- Nonrepetitive (t_P < 50 µs)	±40		V
I_D	Drain Current - Continuous	36	32	A
	- Pulsed	144	128	A
P_D	Total Power Dissipation @ T_C = 25°C	100		W
	Derate above 25°C	0.67		W/°C
T_J,T_{STG}	Operating and Storage Temperature Range	-65 to 175		°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	275		°C

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions		Type	Min	Typ	Max	Units
DRAIN-SOURCE AVALANCHE RATINGS (Note 1)								
E_{AS}	Single Pulse Drain-Source Avalanche Energy	V_{DD} = 25 V, I_D = 36 A		NDP608AE NDP608BE NDB608AE NDB608BE			200	mJ
I_{AR}	Maximum Drain-Source Avalanche Current						36	A
OFF CHARACTERISTICS								
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA		ALL	80			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 80 V, V_{GS} = 0 V		ALL			250	µA
			T_J = 125°C				1	mA
I_{GSSF}	Gate - Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V		ALL			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	V_{GS} = -20 V, V_{DS} = 0 V		ALL			-100	nA
ON CHARACTERISTICS (Note 2)								
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA		ALL	2	2.9	4	V
			T_J = 125°C		1.4	2.3	3.2	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 18 A		NDP608A NDP608AE NDB608A NDB608AE		0.031	0.042	Ω
			T_J = 125°C			0.05	0.08	Ω
		V_{GS} = 10 V, I_D = 16 A		NDP608B NDP608BE NDB608B NDB608BE			0.045	Ω
			T_J = 125°C				0.09	Ω
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 10 V		NDP608A NDP608AE NDB608A NDB608AE	36			A
				NDP608B NDP608BE NDB608B NDB608BE	32			A
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 18 A		ALL	10	17.5		S
DYNAMIC CHARACTERISTICS								
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz		ALL		1370	1800	pF
C_{oss}	Output Capacitance			ALL		390	500	pF
C_{rss}	Reverse Transfer Capacitance			ALL		140	200	pF

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Conditions		Type	Min	Typ	Max	Units
SWITCHING CHARACTERISTICS (Note 2)								
$t_{D(ON)}$	Turn - On Delay Time	V_{DD} = 40 V, I_D = 36 A, V_{GS} = 10 V, R_{GEN} = 7.5 Ω		ALL		11	20	nS
t_r	Turn - On Rise Time			ALL		113	190	nS
$t_{D(OFF)}$	Turn - Off Delay Time			ALL		37	60	nS
t_f	Turn - Off Fall Time			ALL		69	110	nS
Q_g	Total Gate Charge	V_{DS} = 64 V, I_D = 36 A, V_{GS} = 10V		ALL		46	65	nC
Q_{gs}	Gate-Source Charge			ALL		8		nC
Q_{gd}	Gate-Drain Charge			ALL		25		nC
DRAIN-SOURCE DIODE CHARACTERISTICS								
I_S	Maximum Continuos Drain-Source Diode Forward Current			NDP608A NDP608AE NDB608A NDB608AE			36	A
				NDP608B NDP608BE NDB608B NDB608BE			32	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current			NDP608A NDP608AE NDB608A NDB608AE			144	A
				NDP608B NDP608BE NDB608B NDB608BE			128	A
V_{SD} (Note 2)	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 18 A		ALL		0.91	1.3	V
			T_J = 125°C			0.81	1.2	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 36 A, dI_S/dt = 100 A/µs		ALL		88	125	ns
I_{rr}	Reverse Recovery Current			ALL		6	9	A
THERMAL CHARACTERISTICS								
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case			ALL			1.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient			ALL			62.5	°C/W

Notes:
1. NDP608A/608B and NDB608A/608B are not rated for operation in avalanche mode.
2. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%.

Typical Electrical Characteristics

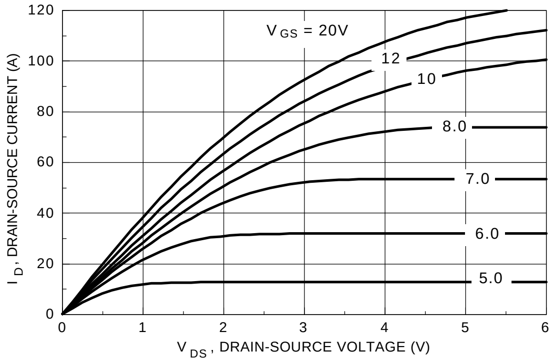


Figure 1. On-Region Characteristics.

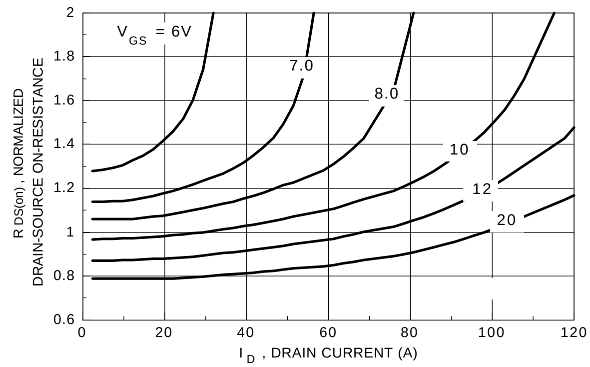


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

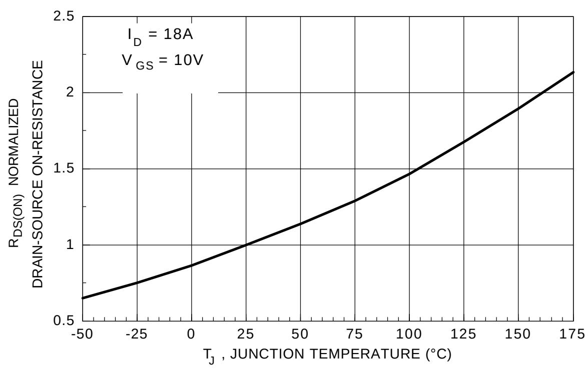


Figure 3. On-Resistance Variation with Temperature.

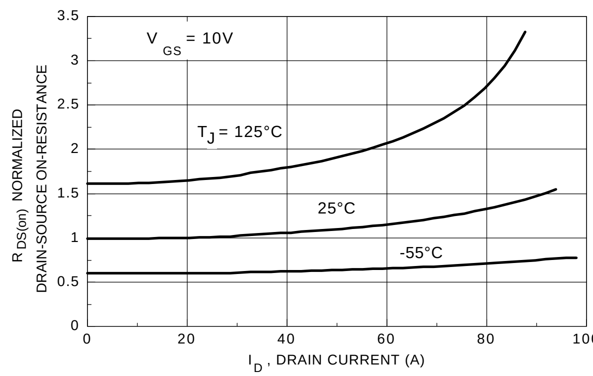


Figure 4. On-Resistance Variation with Drain Current and Temperature.

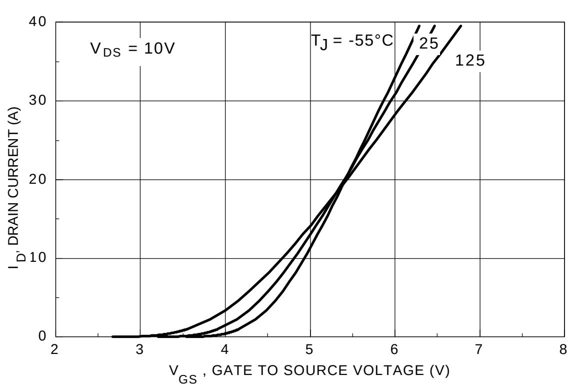


Figure 5. Transfer Characteristics.

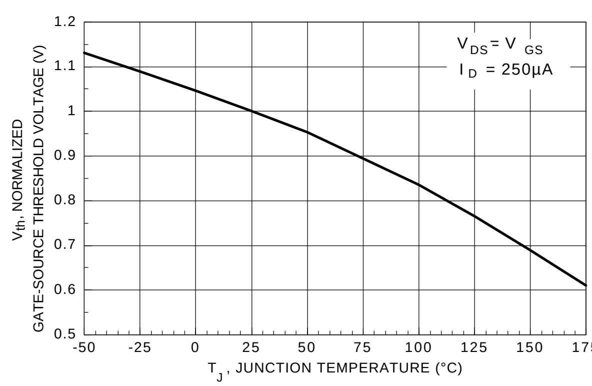


Figure 6. Gate Threshold Variation with Temperature.

Typical Electrical Characteristics (continued)

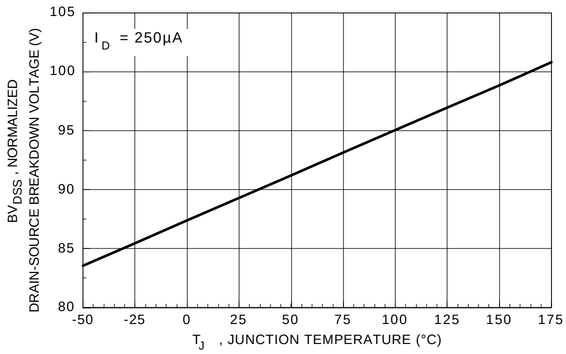


Figure 7. Breakdown Voltage Variation with Temperature.

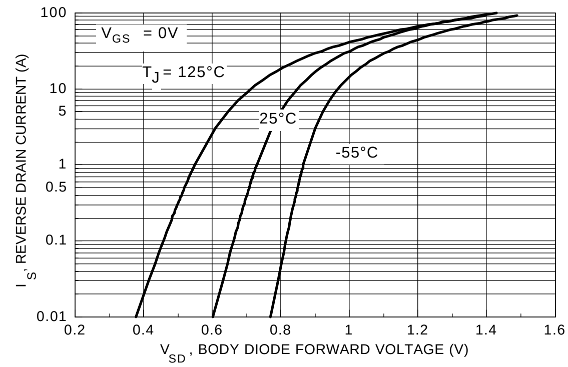


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

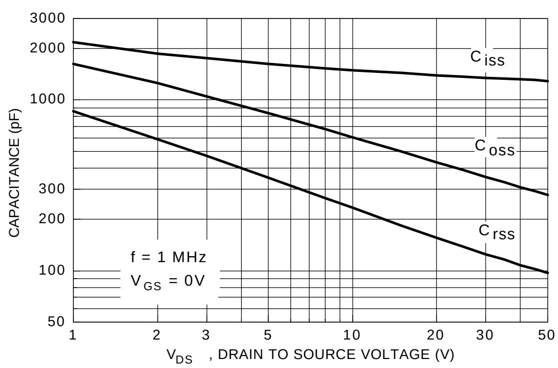


Figure 9. Capacitance Characteristics.

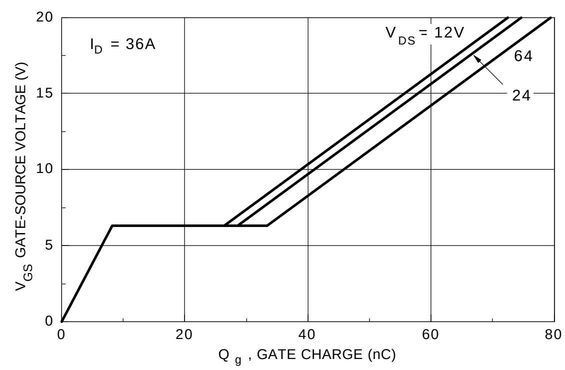


Figure 10. Gate Charge Characteristics.

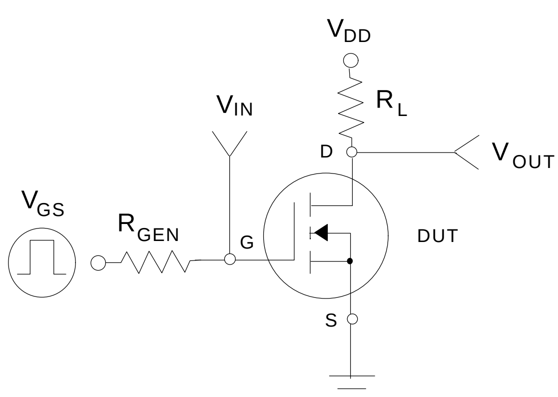


Figure 36. Switching Test Circuit.

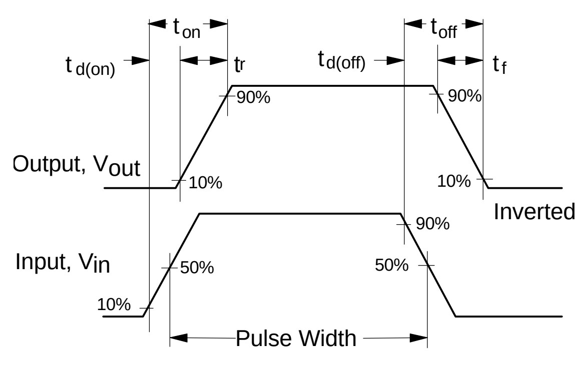


Figure 12. Switching Waveforms.

Typical Electrical Characteristics (continued)

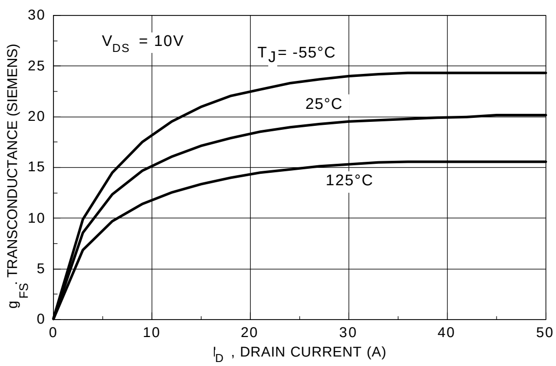


Figure 13. Transconductance Variation with Drain Current and Temperature.

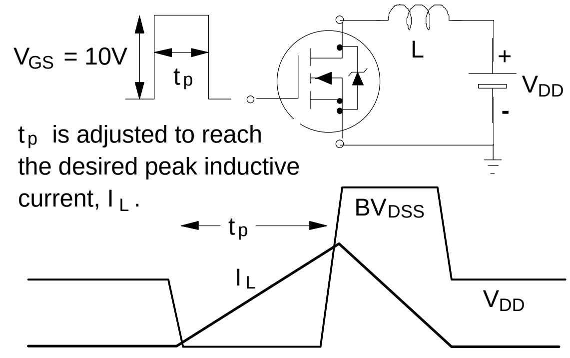


Figure 14. Unclamped Inductive Load Circuit and Waveforms.

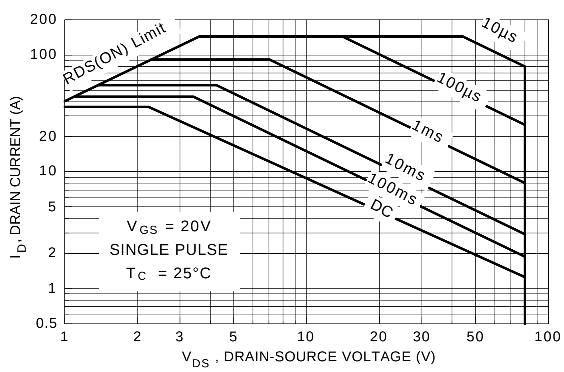


Figure 15. Maximum Safe Operating Area.

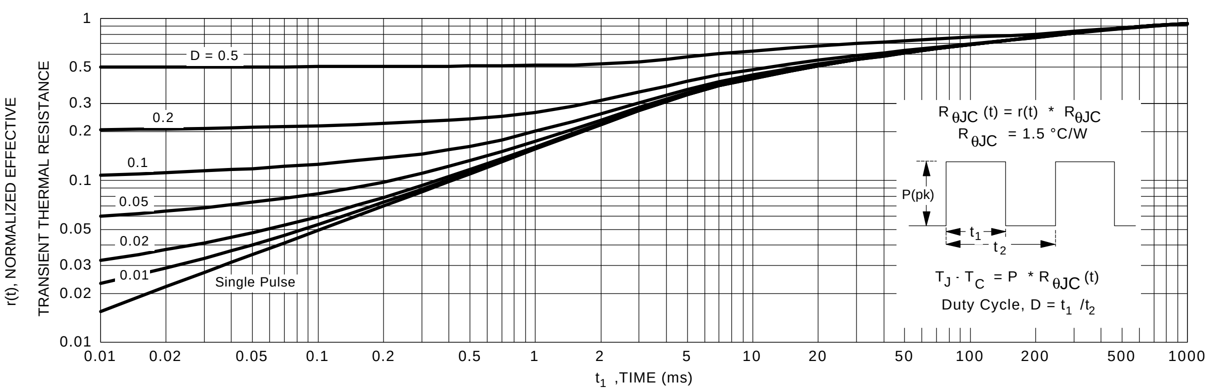


Figure 16. Transient Thermal Response Curve.